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PUBLIC HEALTH REPORTS

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PARATYPHOID FEVER.

REPORT OF AN OUTBREAK IN CASCADE, MONT., CAUSED BY HEAD CHEESE.

By FRED T. FOARD, Passed Assistant Surgeon, United States Public Health Service (R), and T. F. WALKER, M. D., President Cascade County Medical Society, Director Walker Pathological Laboratories, Great Falls, Mont.

On November 27, 1920, there were reported to the health department of Cascade County, Mont., by the local physician of the town of Cascade, Dr. F. C. Vanatta, 30 cases of influenza. On the date of reporting the cases a request was made by Dr. Vanatta for the county health officer, with one of the writers, to come to Cascade from Great Falls for the purpose of seeing a number of the cases with him and for instituting such quarantine measures as might be thought necessary to prevent the further spread of the disease. On the following day, November 28, we visited Cascade and, with the physician in charge, saw 15 of the 28 cases reported in the town to that date. (Two cases had been reported by the same physician from a smaller rural town 10 miles northeast of Cascade.) In practically all of the 15 patients seen on November 28 the symptoms at onset were similar, including the suddenness of onset, headache, chills or chilliness, pain in joints, rapid rise in temperature from 102° F. to 104° F. and persistent thereafter, and very closely simulating the onset of influenza of a rather severe type. At that time the two facts most strongly contradictory to the diagnosis of the outbreak as influenza were (1) the absence of reported cases of influenza in Cascade County since early in the year, and (2) the total absence of pulmonary symptoms in all patients, some of whom were at that time in the seventh day of the disease. Owing to the lack of laboratory facilities for carrying on further diagnostic work in connection with the outbreak, Dr. T. F. Walker, of the Walker Pathological Laboratories of Great Falls, was called in on November 30 to make such laboratory investigations as might be necessary to obtain a definite diagnosis of the condition. Material for a laboratory diagnosis was obtained from a number of patients on November 30, at which time 34 of the 44 cases occurring during the outbreak had been attacked since November 20. Laboratory findings are given later in this report.

GENERAL CONDITIONS.

The town of Cascade has a population of 430. It is a rural town, located on the Missouri River and the Helena-Great Falls division of the Great Northern Railway, 30 miles southwest of Great Falls and about 70 miles northeast of Helena. The town site is on a slightly sloping prairie or table-land lying between the base or foothills of the Belt Mountains on the west and the Missouri River three-quarters of a mile distant on the east. The elevation of the town is a little more than 3,200 feet above sea level. The natural drainage from the mountains toward the river is good but is by no means steep. The 139 homes and 31 business places of the town are all located on a plot approximately one-half mile square, which extends west from the Missouri River toward the foot of the Belt Mountains. There are only two homes on the east side of the river. Practically all of the families living in the town of Cascade are engaged in local business industries of one kind or another. The general prosperity of the town is good, there being no other town larger than Cascade to the north nearer than Great Falls and none larger than Cascade to the south nearer than Helena. The raising of considerable quantities of wheat, hay, and flax along the Missouri River Valley is practically the only agricultural industry of the surrounding country, the main industry being that of raising cattle and sheep for market.

WATER SUPPLY.

The first step in the investigation of the outbreak, after finding that blood specimens taken from a number of different patients had agglutinated with paratyphoid bacillus, was carefully to investigate the town water supply. The supply was found to be derived from two sources, neither of which, after repeated laboratory examinations of water samples taken from them, showed the presence of *B. coli.* The water supply at the time of the outbreak was, and for three months previously had been, collected from 14 small springs, all of which are located approximately 1 mile west of the town proper, at an elevation of about 100 feet above the town, and directly in the foothills of the Little Belt Mountains. All of the springs are against the base or some distance up the side of the first rise of the lower range of mountains, and, at the point where the water makes its first appearance from the rocks, are inclosed by concrete boxes which are tightly covered and from which small collecting pipes carry the water to a main pipe, which, in turn, conveys it to the town reservoir. The reservoir has a capacity of 100,000 gallons, is constructed of concrete, and is tightly covered by sheet-iron roofing. The water is piped from the reservoir, by gravity, to the town, which is approximately one-half mile distant and 60 feet lower in elevation. The water supply of the town is furnished from this source for about eight months of each year. The watershed of this supply is totally uninhabited for miles around, as the country back of the springs is very rough and mountainous. The above supply is not sufficient to furnish water for the town during the summer season, and a town well is maintained for emergency use, from which water is used for fire purposes during the entire year and for domestic purposes when the supply from the springs is not sufficient. This well, although much less satisfactory from the standpoint of location, showed, on repeated examinations of water samples taken from it, an absence of *B. coli*. The well is 12 feet square and 40 feet deep, and has a 6-inch concrete wall from top to bottom. It is located northeast of the center of the town proper and is within about 600 feet of the Missouri River. The bottom of the well is about 20 feet below the bed of the river. The well passes through a black loam for approximately 10 feet from the surface, after which it passes through sand gravel formation throughout the remainder of its depth. The water enters the well from a strong bubbling spring at about the central point of the bottom and rises to a height of about 20 feet, or approximately to the level of the bed of the Missouri River. The depth of the water in the well shows no variation during the year except when the city pumps are working, at which time the normal height is slightly lowered. The water is clear and cold the year round and does not show any turbidity during the rainy spring season, when the river is high and its water muddy. The well itself is covered by a concrete house, in which the city pump, used for pumping the water to the town reservoir, is located. The nearest privy to the well is a pit privy dug to an approximate depth of 12 feet and located about 100 feet from the well.

EXCRETA DISPOSAL.

At the time of the outbreak the town had no city sewer system, but there were two privately owned sewer lines to which approximately 25 per cent of the dwellings and public houses of the town were connected. Of the 139 dwellings and 31 business places in the town, all of the business places were connected to an 8-inch sewer, and 10 private dwellings were connected to a 6-inch sewer line. There were 33 dwellings having cesspools, to which baths and toilets were connected. These cesspools vary in depth from 20 to 40 feet. There were 96 homes having outside pit privies, which vary in depth from 10 to 20 feet. There have never been any excretal removals from any of the pit privies or cesspools. Of the 96 pit privies, there were none found to be water-tight or built in such a way as to prevent the entrance or exit of flies. In that the majority of the 33 cesspools extend in depth to, or very nearly to, the natural water level, it is considered fortunate that no individually owned wells are in use in the town; and in that a number of these pit privies are located above or on the mountain side of the town from the town well, it is surprising that water samples from the town well have, on repeated laboratory examinations, failed to show the presence of colon bacilli.

FOOD SUPPLY.

When the epidemiological investigation was started on November 30, for the purpose of locating the source of the outbreak, an epidemiological questionnaire, which had been previously prepared, was submitted to each of the patients, and the following information was furnished by each:

1. Name, age, sex, and occupation of patient.
2. Date of onset of each case.
3. Number stricken in family.
4. Sources of water supply used.
5. Source of milk supply used.
6. Members of family having been out of town within 10 days, and places visited by each.
7. Public meetings attended where food was served; kind of food consumed at public meetings.
8. All markets from which food that had been served in homes within 10 days previous to onset of illness had been purchased, and the exact kind of food purchased from each, including meat, groceries, vegetables, bread, etc.
9. Restaurant or hotel patronized, if any, within the previous 10 days.
10. Soft-drinks stands patronized.

After summing up the information obtained through the questionnaire, the questions of which were answered by 18 of the patients during the first day of the investigation, it was found that in every instance the patients ill had eaten "headcheese" which had been purchased from a single meat market within the period November 17–20, inclusive. It was later found that this cheese had been prepared by the proprietor of the market on November 17, placed on sale during the afternoon of that day, and on the following days, November 18, 19, and 20. This was the only article of diet of a common source eaten by all the patients. The milk used was supplied by different dairies. There were no privately owned water supplies; the city water supply was universally used throughout the town by all families. As stated above, bacteriological examinations of both of the sources of the city water had failed to show the presence of colon bacilli.

In addition to the information obtained by the writers on the first day of the investigation, it was thought advisable to have the physician in charge secure additional epidemiological information by submitting the above questions to each of his patients when he visited them on the following day. Of the 34 patients who had become ill up to and including November 30, 28 had eaten the headcheese; and the other 6, although denying that they had eaten the cheese, were members of families wherein the cheese had been served and in which other cases existed. All of the 34 cases developed to November 30 were members of 13 families, 11 of which lived in Cascade; one family lived on a ranch 10 miles southeast of Cascade, and one family lived at a small country station on the Great Northern Railway, 11 miles north of Cascade. The family living north of Cascade had visited relatives in Cascade on November 19 and had eaten the headcheese at the evening meal on that day. On November 20 one member of this family was attacked after returning home, and on November 23 the other member who had visited Cascade relatives was attacked. The family living on a ranch 10 miles southeast of Cascade purchased headcheese (the only purchase of provisions which was made in Cascade) from the same meat market on November 20, served it at their home one or two days later, at which time two members of a near-by family of relatives dined with them. On November 25 one member of the family that had made the purchase became ill. One of the members of the visiting family who had eaten the cheese became ill on the 25th and the other on the 27th. About three weeks later three additional members of the visiting family became ill, on December 16, 17, and 18, respectively. These three patients did not eat the headcheese, but were attending the cases stricken on November 25 and 27, from whom the disease was contracted.

CLINICAL COURSES.

In that all cases developed in private homes and were not, with the exception of two families having four cases, attended by special trained nurses, it was impossible to keep clinical records as completely and as accurately as was desired. Care was taken by the attending physician, however, to carefully record the temperature, pulse rate, and presenting symptoms of every case while on his daily round of visits, and only the records kept by the physician are used in this report. Of the 44 cases that developed throughout the entire course of the outbreak, the first on November 20 and the last on December 18, 37 were apparently primary cases and were stricken between November 20 and December 3. One of the seven secondary cases developed in an infant 5 months of age, who was attacked on December 6 while its mother was still suffering from the disease, having been taken ill on November 23. Three of the secondary cases to develop were stricken on December 16, 17, and 18, respectively, and were members of a family in which two cases had developed on November 25 and 27. The remaining three cases to develop as secondary cases were relatives of (also visitors of and attendants to) cases which developed in their family on November 25 and 27, respectively, and were confined to their beds until after December 20.

After an apparent incubation period of from two to eight days, the onset of the disease was very sudden, with practically no prodromal symptoms. It was manifested by severe headache, chills or chilliness, pain in the limbs and joints, backache, and, in a number of the more severe cases, stiffness of the neck associated with excruciating pain on moving the head was noticed. The temperature in practically all cases rose rapidly to 102° F., to 104° F., and, in a few instances, to 105° F. The temperatures remained high with only slight morning remission for the first 10 days, when it fell by lysis, reaching normal about the seventeenth day of the disease. The pulse rates, notwithstanding the high temperatures, were slower than normal. This was a specially noticeable feature and was true in 38 of the total of 44 cases. Another noticeable feature of the disease was the absence of leucocytosis. Unfortunately, owing to the lack of laboratory facilities in the town, we were able to do white blood counts on but seven cases. The highest of these was 8,400, the average being 5,100 per cu. mm. Abdominal symptoms were present in about two-thirds of all cases; 11 vomited during the first 24 hours; 10 had a rather severe diarrhea for the first five or six days after the onset; 19 had considerable abdominal pain and tenderness; and in over half of the cases there was marked abdominal rigidity during the first few days. Two of the cases, both children, aged 1 and 3 years, and members of the same family, had bloody stools. In all cases there was a total absence throughout the disease of pulmonary symptoms. Severe epistaxis was present in one case on the sixth day of the disease, and moderate epistaxis was present in another case on the eighth day of the disease. In no case were we able to palpate the spleen.

One of the most characteristic features was the eruption which appeared from the fifth to the seventh day of the disease, and which was well marked in 40 of the 44 cases. This eruption consisted of small, slightly raised, and roughened, reddish spots about 2 mm. in diameter. They paled somewhat, but did not completely disappear under pressure. They resembled typhoid rose spots in color, but differed from them in being slightly raised and distinctly palpable. They appeared from about the fifth to the seventh day of the disease and persisted for about one week after their appearance. In most cases they were quite numerous, and appeared on all parts of the body except the palms of the hands and soles of the feet. In Table I, showing the collective symptomatology of all cases, they are listed as rose spots.

TABLE I.—*Collective symptomatology shown by patients attacked.*

Symptom.	Patients having symptom.	Patients not having symptom.
Sudden onset	38	6
Severe headache at onset	41	3
Chills or chilliness at onset	41	3
Pain in limbs and joints at onset	23	21
Diarrhoea at onset (persistent 5 days)	10	34
Vomiting at onset	11	33
Pain in abdomen	19	25
Severe backache	28	16
Stiffness of neck	12	32
Rigid abdomen	24	20
Rose spots	40	4
Palpable spleen	0	44
Bradacardia	38	6
Tachacardia	6	38
Bloody stool	2	42
Epistaxis	2	42
Delirium	8	36

Ate suspected food: Yes, 28; no, 16.
Ate other food bought at same market and served with suspected food, 6.
Secondary cases in previously stricken families, 10.

LABORATORY FINDINGS.

The bacteriological findings represent 20 cases which were selected from 10 of the total of 15 families which were attacked during the outbreak. Widal reactions were made upon the blood of the 20 cases, blood cultures on 9 cases, blood counts on 7 cases, and the stools of 10 cases were examined. The results of these various examinations are presented in Table II.

TABLE II.—*Paratyphoid fever, Cascade, Mont., laboratory findings.*

Family.	Case No.	Onset.	Date examined.	Blood culture.			Widal reaction.			Stool.			Leucocyte count.
				Typhoid.	Paratyphoid.		Typhoid.	Paratyphoid.		Typhoid.	Paratyphoid.		
					A.	B.		A.	B.		A.	B.	
1	1	Nov. 20	Dec. 2	—	—	—	+	—	+	—	—	+	8,400
	2	23	7	—	—	—	+	—	+	(1)	(1)	(1)	(1)
2	1	20	7	(1)	(1)	(1)	+	—	+	(1)	(1)	(1)	(1)
	2	23	7	—	—	—	—	—	+	—	—	—	(1)
3	1	21	7	(1)	(1)	(1)	—	—	+	—	—	—	6,900
	2	23	7	(1)	(1)	(1)	—	—	+	(1)	(1)	(1)	(1)
	3	26	7	—	—	—	+	—	+	—	—	—	(1)
4	1	24	7	(1)	(1)	(1)	—	—	—	—	—	—	(1)
	2	26	7	(1)	(1)	(1)	+	—	+	(1)	(1)	(1)	4,300
5	1	22	7	—	—	—	—	—	+	(1)	(1)	(1)	5,400
	2	23	7	(1)	(1)	(1)	—	—	+	—	—	—	(1)
	3	24	7	—	—	—	—	—	+	(1)	(1)	(1)	4,100
	4	25	7	(1)	(1)	(1)	—	—	+	—	—	—	(1)
	5	25	7	—	—	+	+	—	+	—	—	+	(1)
	6	Dec. 1	7	(1)	(1)	(1)	+	—	+	—	—	—	(1)
6	1	Nov. 22	7	(1)	(1)	(1)	—	—	+	(1)	(1)	(1)	6,400
7	1	23	7	—	—	—	—	—	+	—	—	—	(1)
8	1	24	7	—	—	+	—	—	+	—	—	—	5,400
9	1	25	7	(1)	(1)	(1)	+	—	+	—	—	—	(1)
10	1	27	7	(1)	(1)	(1)	+	—	+	—	—	+	(1)
Total						+2	+9		+19			+3	

(1) Not made.
Positive laboratory findings indicated by +; negative laboratory findings indicated by —.

In making the blood cultures, 3 c. c. of blood were drawn from the vein at the elbow and planted in 15 c. c. of lactose bile medium. After incubating for 24 hours, plates were made on Endo's medium; and after 24 hours any suspicious colonies were transferred to bouillon and to Russell's double-sugar medium. After securing a growth on these media the organisms were positively identified by culture and specific agglutination tests.

In the examination of the stools, the feces were first shaken up in about 20 volumns of sterile water; and after the suspensions had stood for an hour, three loopfuls were transferred to as many plates of Endo's medium. After 24 hours, suspicious colonies were transferred to Russell's double-sugar medium, and from the growth here obtained, the organisms were positively identified by culture and specific agglutination tests. The relatively small per cent (22) of positive blood cultures can possibly be explained by the fact that the blood cultures obtained on December 7 were taken relatively late in the course of the disease. In fact, we were surprised to find any of them positive, as all of the cases cultured gave positive Widal reactions. On the other hand, we were pleased to secure as high a per cent (15) of positive cultures in the feces as we did. The blood serum of all but one of the cases gave positive Widal reactions with *Bacillus paratyphosus* B. in a dilution of 1–40 in one hour. It was interesting to find that although the Widal was positive with *B. typhosus* in 9 cases, in no case was it positive with *B. paratyphosus* A. In these 9 cases the Widal was undoubtedly positive by reason of group agglutinins, since in only one of these was it positive with *B. typhosus* in a dilution of 1–100, whereas in all of them it was positive with *B. paratyphosus* B. in a dilution of 1–100, and also since saturation of the serums with *B. paratyphosus* B. removed the agglutinins for *B. typhosus*.

In only one of the cases upon which white blood counts were made was the number of leucocytes above 7,000, and in the remainder it varied from 4,100 to 6,900.

Repeated samples of water taken from the different springs furnishing the town water supply, from the bottom and the surface of the town well, and from the bottom and surface of the town reservoir showed no *B. coli* or *B. paracoli* A. or B. in quantities of 1 c. c. or 10 c. c. Five samples of milk from various sources were negative for *B. paratyphosus* B. We were likewise unable to isolate *B. paratyphosus* from a number of samples of meat taken from the market from which the supposedly contaminated food was sold and which was in stock at the time when the suspected food was on sale. It was impossible to obtain a sample of the suspectedly contaminated headcheese from the market where it was prepared and sold, as the supply had been exhausted on the 20th of November.

A sample was obtained, however, from a customer; but as it was in an advanced stage of decomposition, our failure to isolate *B. paratyphosus* from this sample was considered to have but little significance.

INCUBATION PERIOD.

In arriving at the incubation period, only 37 of the 44 cases are considered, as there was no means by which the incubation period of the supposedly secondary cases could be accurately estimated. Apparently, the incubation period was from 2 to 13 days, with an average of approximately 7 days. Of the 37 cases considered in determining the average incubation period, 4 are regarded as questionable primary infections. One of these 4 questionably primary cases developed on November 30, 2 developed on December 1, and 1 on December 3. Although all 4 of these patients were members of families in which the disease had occurred within three days after the initial outbreak, and in which the suspected contaminated food had been served daily from November 19 to 22, one of the patients denied having eaten any of the suspected food or other food which had come from the meat market which had sold the suspected food; 2 of the 4 possible secondary cases denied having eaten the suspected headcheese, but admitted having eaten other meat which was purchased from the same market at the time the suspected contaminated food was purchased; and 1 patient admitted having eaten the suspected headcheese 12 days before being attacked with the disease on December 3. In each instance these 4 cases were members of a family in which the disease had occurred on the second or third day of the outbreak. Of the total of 44 cases reported in the outbreak, 33 are considered to be unquestionably primary infections, and all of these cases developed within 10 days from the date on which the suspected contaminated food was placed on sale and within 7 days from the date on which the supply of the suspected contaminated food was exhausted at the market. Of these 33 cases, 28 remembered distinctly having eaten the suspected food, and the other 5 remembered distinctly having eaten beef that had been purchased and served at the time when the suspected headcheese was purchased and eaten in their home.

The one instance of the outbreak which points more clearly than any other to the incubation period, and proves most conclusively that the source of the outbreak was the food suspected, is the case of the family living in the town of Ulm, 15 miles north of Cascade. Two members of this family visited Cascade on the afternoon of November 20, had their evening meal on that date with relatives living at Cascade, at which time they ate the suspected headcheese, the only meat served which had been purchased from any market, and returned to their home on the morning of November 21. They were stricken with the disease on November 23.

THE CHRONOLOGY OF THE OUTBREAK.

The chronology of the outbreak, as shown by the accompanying chart, is interesting in that the initial cases of 14 of the 15 families attacked, living in different sections of the town, developed within 10 days from the time that the suspected food was placed on sale. In every instance the patients attacked remembered distinctly having eaten the suspected food. Although the outbreak extended over a period of 28 days, 33 of the 44 cases developed within 8 days from the date of the appearance of the initial case of the outbreak. The chronology of the outbreak, by date of onset of cases, is given in Chart 1.

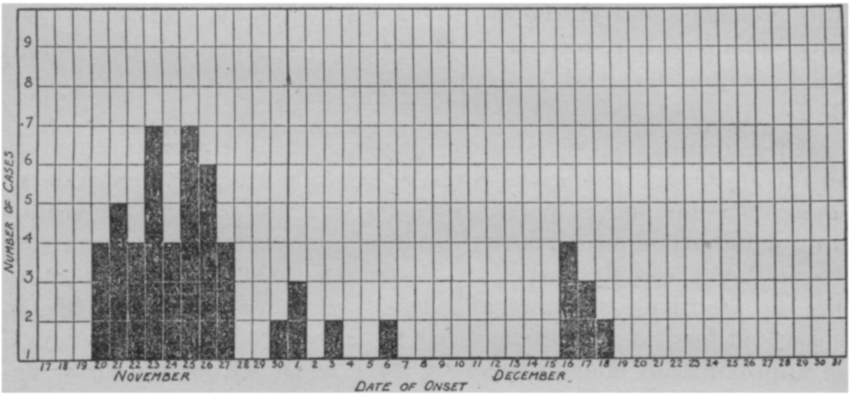

Chart 1.—Chronology of outbreak of paratyphoid fever, Cascade, Mont., by dates of definite onset.

PERSONS ATTACKED.

The persons attacked were from homes widely distributed throughout the town, and were of various ages, from 5 months to more than 50 years. In most instances the homes of families attacked were clean and neatly kept, and particular pains were taken to prevent the occurrence of secondary cases. Table III gives the sex and age of the persons attacked.

Table III.—*Sex and age of persons attacked.*

Sex.	Ages, in years.							
	0-4	5-9	10-14	15-19	20-29	30-39	40-49	50-59
Male	3	3	4	2	....	1	4	2
Female	2	3	6	3	2	3	5	1
Total	5	6	10	5	2	4	9	3

CONTACTS.

The total population of the town of Cascade is 430. All families have been residents of the town for a number of years, practically every resident is personally acquainted with every other resident, and there is considerable intermingling of families. On investigation, however, not a single instance was found where a stricken patient had visited or dined with any other family or had attended any picnic or public gathering upon which occasion suspicion could be laid as a possible source of the infection, other than those cases cited where the headcheese was served. The milk used by the different stricken families came from three sources. One is a town creamery, to which milk is sold from a number of different ranches. On examination of the milk supply, there was no indication, from a bacteriological standpoint, that the outbreak had spread through the milk; and on carefully questioning the employees at this creamery and at the two local dairies, it was not found that any employee had recently suffered from a disease which might have been paratyphoid.

CONCLUSIONS.

After summing up the evidence obtained through the investigation of this outbreak, which was made as carefully and as much in detail as was possible under the circumstances, it is the belief of the writers and of the attending physician to all of the cases that the source of the outbreak was the suspected headcheese. On carefully questioning the proprietor of the meat market who prepared and sold the suspected food, it was learned that his wife had been ill for a period of approximately four days about three weeks before the outbreak. It was also learned that she had assisted in preparing the suspected food two days before it was placed on sale and about 10 days before the beginning of the investigation. Although all members of the proprietor's family were carefully questioned at the time of the investigation, the information concerning the illness of the proprietor's wife was not obtained until several weeks after the investigation had been completed, and at that time she was out of the town. It was therefore impossible to obtain a Widal (agglutination) examination of her blood.

NOTE.—The preparation and submission of this report for publication is mainly for the reason that the literature on detailed reports of clear-cut paratyphoid outbreaks is very limited. It is also the desire of the writers to emphasize the importance of careful epidemiological investigations of food supplies along with the usual investigations that are made of water and milk supplies in connection with such outbreaks of paratyphoid, typhoid, and other epidemic intestinal diseases. Although there was no indication that the water supplies were in the least responsible for the outbreak here reported, it is believed that frequently in such outbreaks conclusions are arrived at too quickly when colon bacilli are found in small quantities in the water supply. The outbreak is then frequently attributed to the water supply, and no further investigation of the food supplies is made.

THE NATIONAL HEALTH COUNCIL.

By H. S. CUMMING, Surgeon General, United States Public Health Service, Representative of the United States Public Health Service on the National Health Council.

The National Health Council is an organization composed of the nine leading national voluntary health agencies of this country, together with the United States Public Health Service as a conference member. The members are as follows:

American Public Health Association.
American Red Cross.
American Social Hygiene Association.
Conference of State and Provincial Health Authorities of North America.
Council on Health and Public Instruction of the American Medical Association.
National Child Health Council.
National Committee for Mental Hygiene.
National Organization for Public Health Nursing.
National Tuberculosis Association.
United States Public Health Service (conference member).

The present officers of the council are as follows: Chairman, Dr. Livingston Farrand; vice chairman, Dr. L. K. Frankel; recording secretary, Dr. S. J. Crumbine; treasurer, Dr. W. F. Snow. Each member organization elects a representative and an alternate to serve on the Council. The Surgeon General represents the United States Public Health Service, and the alternate of the service is Surgeon J. D. Long. In addition to the member organizations listed above, the American Child Hygiene Association, the Child Health Organization of America, and the National Child Labor Committee are indirectly members through their affiliation with the National Child Health Council. Provision is made for additional members, including organizations national in scope whose primary interest is in health. It is probable that the council will experience a gradual growth.

The council was created on December 10, 1920, at a conference of a number of national voluntary health agencies held in Washington. The desirability of such a council had been discussed for many years, and several efforts, initiated by the American Medical Association, the American Public Health Association, and other agencies, had been